Missouri Watershed Protection Practice



2006 Management Guidelines for Maintaining Forested Watersheds to Protect Streams

MISSOURI DEPARTMENT OF CONSERVATION



Foreword

This booklet has been prepared as an educational tool to inform landowners, loggers, foresters and other interested persons about the nature of non-point source water pollution from silvicultural operations.

The methods of reducing non-point source water pollution are called recommended practices which are adapted to suit Missouri forests, soils and logging conditions. The booklet review team consists of 30 persons representing various aspects of forestry in Missouri.

The review team believes these practices are economical, common-sense methods for ensuring Missouri forests continue to produce water of the highest quality.

Acknowledgment

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- Missouri Department of Conservation
- Missouri Department of Natural Resources
- Missouri Forest Products Association
- University of Missouri, College of Natural Resources
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Recommended Water Quality and Watershed Protection Practices for Missouri Forests

Introduction

This booklet provides a brief description of Missouri forests including their acreage, ownership, the contribution to the state's economy made by the forest products industry and a description of non-point source water pollution control practices. Use of the recommended non-point source water pollution control practices should ensure the continued flow of high quality water from Missouri forests.

The purpose of this publication is to inform persons involved in forest land management about the importance of reducing non-point source water pollution resulting from silvicultural activities and to describe some techniques used to reduce the impact on water resources. Although the recommended practices described are intended for use on state conservation areas, land managers are encouraged to inform private forest landowners and loggers about the importance of reducing non-point source water pollution.

Information presented in this report is not to be used as the basis for setting water quality standards or as the basis for the use of watershed protection practices. Compliance with any watershed protection practices should be on a voluntary basis backed by a public water quality education and awareness program. Changing of water quality standards or the required use of protection practices should not be attempted without careful study of the beneficial effects gained from modifying existing silvicultural practices now in use.

Planning to protect the quality of water from non-point source water pollution is provided for in Sections 208 and 404 of the 1972 Federal Water Pollution Control Act (Public Law 92-500), as amended by the Clean Water Act of 1977 (Public Law 95-217), and as amended by

Section 319 of the Clean Water Act of 1987 (Public Law 100-4). The basic goal of the federal law is to protect and improve the quality of the nation's water so it is available for recreational use.

References cited include soil erosion studies carried out in the eastern hardwood forest at the Fernow Experimental Forest in West Virginia, Hubbard Brook Experimental Forest in New Hampshire, University Forest in Missouri, and Boston and Ouachita Mountains of Arkansas. Sediment traced to road construction, maintenance and use is a non-point source water pollutant. The logging road system, consisting of haul roads, landings and skid roads, are sites on a timber harvest area where sediment is produced. Included in the logging road system are the county and state maintained gravel and paved roads. In Missouri, most of the main haul roads are public roads. Usually construction of main haul roads is limited to the temporary use roads extending from the harvest area to the public roads. These temporary use roads are typically short in length and are abandoned after their use.

Because sediment is the non-point source pollutant traced to silvicultural activities, many of the recommended practices found in this publication target reducing sediment production.

The Missouri Forest and Forest Products Industry

Commercial forest land acreage in Missouri is estimated at 14.08 million acres, or about 22 percent of the total land area of 44.3 million acres. About 83 percent, or 11.7 million acres of the commercial forest land area is privately owned by farmers and individuals. The remaining commercial forest land is under management of the U.S. Forest Service, Ft. Leonard Wood, state forests and wildlife areas, state parks and local governments (Hahn). Reserved forest land totals approximately 316,000 acres including parks and wilderness areas where harvesting is not conducted.

Privately owned forests are generally small acreages that are managed for a variety of objectives including periodic income from the sale of timber, recreational uses, aesthetics, woodland pasture and other considerations.

The forest products industry makes a significant contribution to the Missouri economy. The annual harvest of timber is estimated at over 669 million board feet of cumulative sawtimber, veneer and stavebolts. In addition, over 32,250 persons are employed with wages paid totaling over $1.1 billion (Missouri Dept of Conservation). The value of wholesale products is estimated at approximately $4.4 billion annually. Stumpage, the money paid to landowners for the harvest of their timber, is estimated at $119 million in 2003 (Tuttle).

Harvesting of timber, the most common silvicultural practice, is conducted to maintain a healthy, productive forest, maintain a diverse selection of tree and plant species, modify wildlife habitat, produce commercial products and reach the objectives of the landowner.

To some extent, silvicultural practices do affect water quality. However, the effects are of short duration and return to a preharvest condition occurs within a three to seven year period depending upon the source of contamination. Generally there is no permanent degradation of water

resources. Timber harvesting, the most common silviculture activity, occurs infrequently on a specific acreage and annually affects about two percent of Missouri's commercial forest land.

Forest cover, consisting of the tree canopy, coarse debris and the litter layer of decomposing leaves has been recognized as the best protection against soil erosion. Seldom does overland flow of water occur in forest land that is free of livestock grazing.

Streamside Zones

Streamside zones are the land and vegetation areas adjacent to non-ephemeral streams, caves, springs and lakes which require special consideration. These streamside zones are important areas in maintaining stable streambanks. In addition, sediments and a variety of water pollutants are deposited before entering our water resources. Streamside zones need special care and some restrictions during silvicultural operations are needed so water quality is maintained or improved.

The filtering ability of the streamside zone forests help to trap sediments, stabilize streambanks from the erosive effects of water, slow high velocity flood waters that cross flood plains and provide shade to streams, moderating water temperature. The deep, moist soils of many streamside forests provide sites where there is potential for individual, high quality trees and bottomland tree species. Silvicultural practices should be conducted to establish streamside forests, enhance forest productivity, and reach the landowner's objective. The flow of water should not be altered as a result of a silvicultural operation.

Streamside zones are separated into two parts. A primary filter strip which is a 25-foot-wide strip of vegetation measured from the top of the streambank, extending away from both sides of the stream. A secondary filter strip is of variable width and is defined by a factor, measured in feet, of twice the slope percentage of the surrounding land added to the 25-foot-width of the primary filter strip. Figure 1 pictures a streamside zone. Table 1 lists distances recommended for filter strip widths that reduces sediment, originating in disturbed areas, from reaching streams (Trimble). To allow fish and wildlife habitat considerations in addition to sediment control, a wider streamside zone may be recommended.

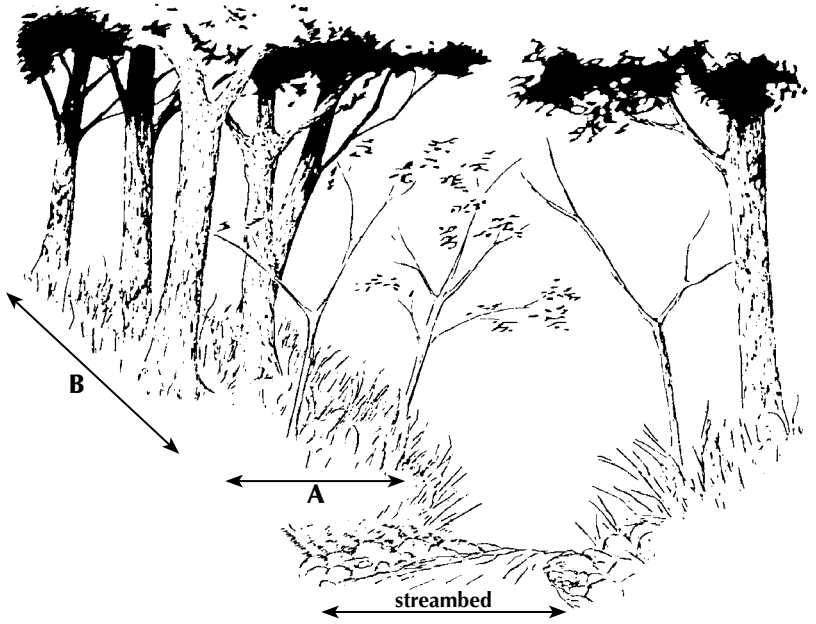


Figure No. 1 - Streamside Zones

A. Primary Streamside Zone — 25-foot-width measured from the top of the streambank on both sides of the stream channel except when associated with bluffs.

B. Secondary Streamside Zone — Variable in width depending on slope of surrounding land. Width is calculated by twice the slope percentage, then added to the primary zone width of 25 feet.

Table No. 1

Use Of A Streamside Zone As A Filter Strip

Slope of Land between Road and Stream (Percent)	Width of Filter Strip for Common Logging Areas (Feet)
0	25
10	45
20	65
30	85
40	105
50	125
60	145

Primary Streamside Zone Recommended Practices

1. Harvesting operations should leave a residual stand of trees at about C-Level stocking, or about 40 square feet of basal area.
2. Cabling out of logs.
3. Direct seeding, hand planting or mechanical planting to establish a streamside forest.

Practices to Avoid

1. Use of wheeled or tracked vehicles within 25 feet of the streambank.
2. Leaving trees or tops in the water.
3. Building of roads within 25 feet of the streambank, except at designated stream crossings. Refer to the section about stream crossings. (Figure No. 1, Table No. 1)
4. Wildfire.
5. Any type of mechanical site preparation that exposes mineral soil except for the establishment of a streamside-zone forest.
6. Portable sawmills, log storage or log landings.
7. Any use of pesticides not labeled for use near water.
8. Livestock grazing.

Secondary Streamside Zone Recommended Practices

1. Harvesting operations should leave a residual stand of trees at C-Level stocking, about 40 square feet of basal area.
2. Careful use of wheeled or tracked vehicles.

Practices to Avoid

1. Building of roads or trails, unless absolutely necessary for stream crossings. Refer to the section about stream crossings. (Figure No. 1, Table No. 1)
2. Portable sawmills, log decks or log landings.
3. Any type of mechanical site preparation that exposes mineral soil except for the establishment of a streamside forest.
4. Leveling gullies, unless immediately seeded and mulched.
5. Any use of pesticides not labeled for use near water.
6. Livestock grazing.
7. Wildfire.

Although not a silvicultural practice, grazing affects about 27 percent of the private forest land in Missouri. Sediment yield from unrestricted grazing on privately owned forests was identified as a more serious problem than the yield of sediment from silvicultural practices (Winters).

Stream Crossings

Because an increase of sediment is common at stream crossings, road building and vehicle travel across streams should be avoided whenever possible. In most cases, advanced road planning will reduce or eliminate the number of stream crossings necessary.

Recommended Practices

1. Plan the location of roads to minimize the number of stream crossings.
2. Install properly sized culverts where permanent logging roads cross streams (Figure No. 2 and Table No. 2).
3. Locate crossings at right angles to the stream channel and where the bottom is hard and relatively level.
4. Protect permanent crossings with coarse rock or large stones.
5. All approaches to stream crossings, whether on temporary or permanent roads, should be made at gentle grades.
6. Soil around culverts, bridges and crossings should be stabilized with coarse rock or large stones.

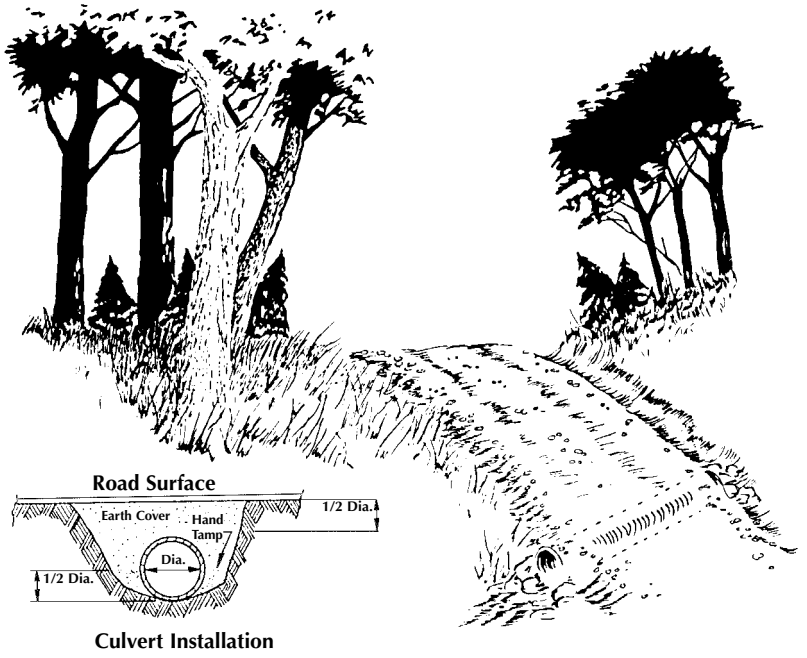
Practices to Avoid

1. Temporary crossings of logs and brush topped with soil.
2. Any practice that would alter the flow of stream water.

Access Roads and Their Construction

For most harvesting operations in Missouri, the construction of special logging roads is not required. Usually the main haul road is the county or state government maintained gravel or paved road system. Nearly 90 percent of the erosion from timber harvests comes from the road system where soil loss from construction and use is similar to soil loss from tilled crop fields (Winters). Soil loss from tilled crop fields ranges from about 2 tons per acre per year to over 100 tons per acre per year (Scoles).

Where an abandoned road bed exists, it should be evaluated for use so new road construction is kept to a minimum. Evaluation of the abandoned road should include the following recommended practices.



Culvert Installation

Figure No. 2

Install at a 30 degree angle down hill for drainage.

Table No. 2

Drainage Area (Acres)	Culvert Pipe Diameter (Inches)
less than 10	15
10	18
50	42
100	48
200	72

Recommended Practices

(Note: Use of all the listed practices on a given road segment may not be practical.)

1. Roads should be planned, located and constructed to provide adequate water drainage from road surfaces. Locating roads along the contour should result in gradual grades. Caution is advised so excessive soil disturbance does not occur if the road bed follows the contour of steep slopes.
2. Locate roads above flood plains and wet areas, if possible.
3. Road grades should be kept at less than eight percent, except where terrain requires short length, steep grades.
4. Construct roads with gradual curves which are wide enough for the efficient operation of heavy equipment. The road bed on temporary roads should be 12 to 14 feet wide.
5. Surface road beds with gravel where necessary for the support of heavy equipment and to protect the road surface from erosion.
6. Keep roads reasonably free of logging debris which prevents free flow of water from the road surface.
7. Remove shading trees along roads as needed to expose the road to the drying effects of sunlight and air movement.
8. Pile cleared debris on the lower side of fill slopes to restrict soil movement.
9. Use culverts as needed to route water under the road to insure proper road drainage. The culvert should be large enough in diameter and positioned across the road to insure proper water drainage (Figure 2 and Table 2).
10. Broad base dips should be located at the proper intervals to channel water across the road. The dips should be outsloped about three percent and surfaced with large rock for adequate drainage (Figure 3 and Table 3).
11. Water bars should be used when retiring temporary access roads and main skid trails (Figure 4 and Table 4).
12. Roads constructed within streamside zones should have all exposed soil immediately stabilized using mulch and grass seed where practical (Table 5).
13. Water turnouts should be constructed to divert water from roadside drainage ditches so excessive flow does not accumulate (Figure 5 and Table 3).
14. Shape cut and fill slopes, seed with grass and cover with mulch to stabilize slopes (Figure 6 and Table 5).
15. When all forestry practices are completed, temporary access roads should be retired by reshaping, seeding and mulching in combination with the use of water bars (Figures 4 and 7 and Table 5).

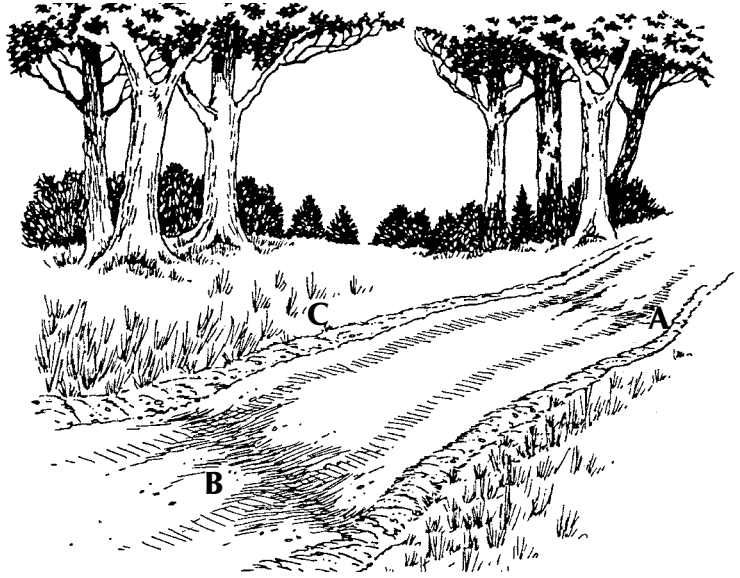


Figure No. 3 Broad Base Dip Construction

A. To spill water from the road in small quantities.
B. Three inch rock used in the base of dips to allow water drainage and protect the road surface.
C. Seeded as necessary to stabilize soil.

Table No. 3

Spacing of Broad Based Drainage Dips

Road Grade (Percent)	Approximate Distance Needed Between Dips or Turnouts (Feet)
1	500
2	300
5	180
10	140

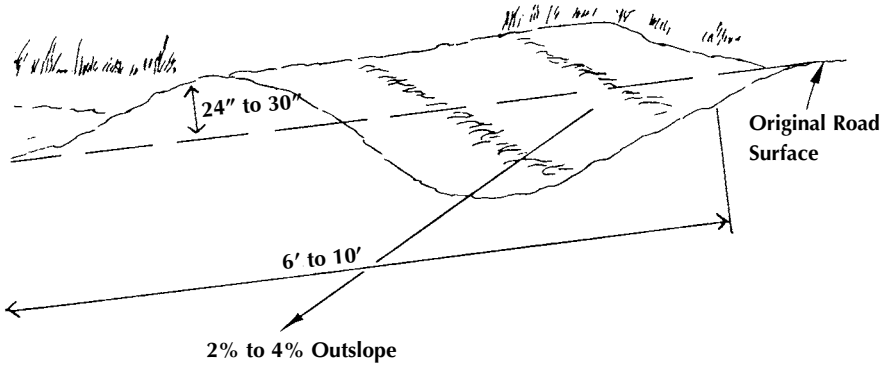


Figure No. 4 Water Bar Construction

Table No. 4

Spacing Between Water Bars

Road Grade	Approximate Distance Needed Between Water Bars (Feet)
1	400
2	245
5	125
10	78
15	58
20	47
25	40
30	35
35	32
40	29



Figure No. 5 Water Turnout Construction

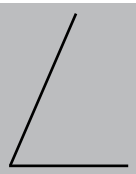
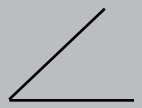
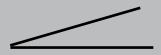
A. Culverts collect and divert water under the road.
B. Collect water at the top of the grade.
C. Water collected at mid-slope is diverted from road ditches in small quantities.

Table No. 5

Seeding Table

Seeding Mixture	Seeding Rate	Seeding Dates Lbs./Acres
Smooth Brome	14	03/15-06/01
Alfalfa	16	08/01-09/15
Orchardgrass	4	03/01-05/15
Timothy	2	03/01-05/15
Switchgrass	2	03/01-05/15
Birdsfoot Trefoil	7	03/01-05/15
		08/15-10/15
Red Top	5	03/15-06/01
Lespedeza	22	03/01-05/15
Switchgrass	6	04/15-06/15
Smooth Brome	5	04/01-06/01
Big Bluestem	7	04/15-07/01
Indiangrass	7	04/01-06/15
Big Bluestem	1.5	04/15-07/01
Little Bluestem	1.0	04/15-07/01
Indiangrass	1.5	04/15-07/01
Sideoats	4.0	04/01-06/15

Figure No. 6 Guide for Stabilizing Roadbanks

Slopes	Treatment
1/2 to 1 	These slopes sometimes hold without treatment. If the soil is unstable and subject to caving, the bank must be resloped to a lower angle.
1 to 1 	Mulching and fertilization is almost always necessary.
2 to 1 	Can loosen to apply fertilizer and seed; should use light mulch on droughty soils.
4 to 1 	Can cultivate with machinery; drill in fertilizer and seed.

This guide generally applies to roadbanks with significant height to warrant treatment. It may not be practical or necessary to seed banks of many logging roads.

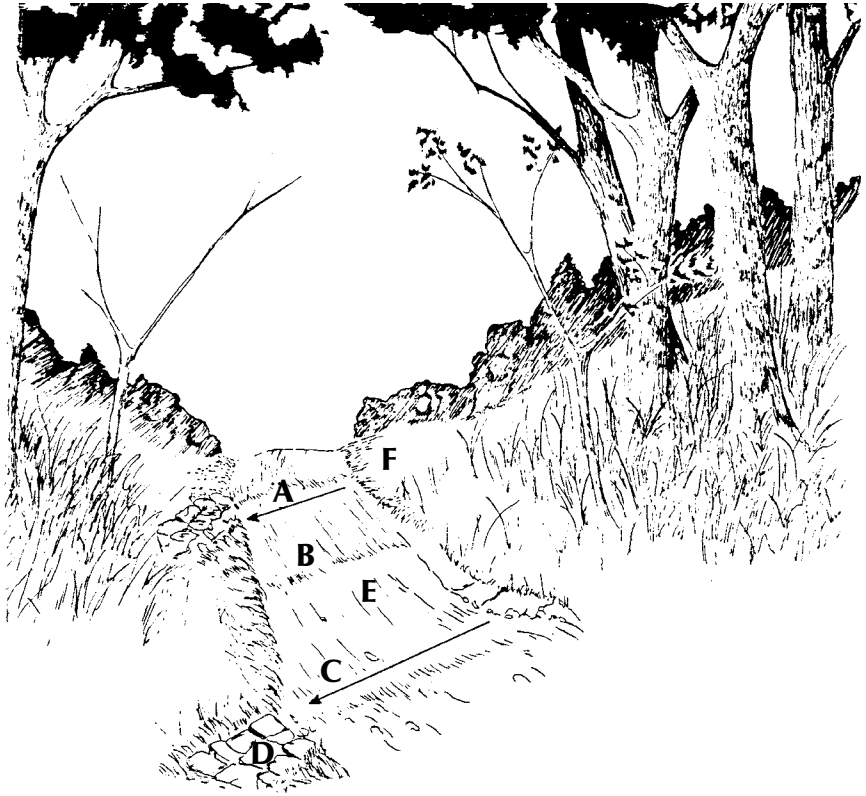


Figure No. 7 Features of a Protected Road

A. Water bar at the top of the grade.
B. Water bars spaced properly at the recommended distances.
C. Water bars located at a 30 degree angle down slope.
D. Stone riprap at diversion outlets.
E. Road is out-sloped and follows the contour.
F. Cut banks are seeded as necessary.

Practices to Avoid

1. Construction of roads in streamside zones as much as possible. Refer to the protective filter strip described in Figure 1.
2. Using roads during wet or saturated soil conditions.
3. Locating roads in stream beds.

Timber Harvesting

Missouri timber harvests typically cover small acreages, and do not require extensive road construction for access. Vegetation responds rapidly to stabilize exposed soil. Long-term studies conducted on managed forest land show that soil erosion occurs at about the same rate as naturally occurring geologic erosion (Miller, E.L., et al; Mussalem, K.E.; and Patric, J.H.). Timber harvesting activities pose little threat to water quality when care is taken to prevent or minimize soil erosion.

Recommended Practices

1. Follow the practices found in the Streamside Zone section when harvesting timber near streams, lakes, caves and springs.
2. Locate log landings on stable, adequately drained soils and so skidding is directed away from stream course.
3. Log landings should be no larger than necessary to handle loading activities.
4. If soil erosion appears to be a problem on log landings, the soil should be seeded when harvesting operations have been completed.
5. Portable sawmills should be located away from any stream or body of water.
6. Provisions should be made at lunch areas and portable sawmills for disposal of human waste and garbage.

Practices to Avoid

1. Changing the oil in logging equipment where it will have an impact on water quality. If machinery is serviced in the forest, collect the oil in containers for proper disposal.
2. Disposal of logging debris in streams and lakes.
3. Temporary crossings made from logs piled into streams should not be used, as they are usually not removed following harvesting. The result of blocked stream channels is the altered flow of water and increased streambank erosion.

Site Preparation

Site preparation is a basic silvicultural tool used to control competing vegetation and reduce logging debris. Several procedures should be considered so water quality is not impaired. Growth of natural vegetation and planted tree seedlings rapidly stabilizes soil movement. Within a three to four year period following site preparation, soil loss returns to a pretreatment condition (Blackburn, et.al.).

Recommended Practices

1. Analyze and plan site preparation, taking into account all aspects of the practices found in the section on Streamside Zones.
2. Bulldozing should disturb as little soil as possible.
3. When windrowing, debris should be left along the contour. Breaks should be left in the windrows to allow for fire control.
4. Seed selected herbaceous vegetation to quickly establish ground cover in addition to the tree crop.

Practices to Avoid

Avoid mechanical site preparation which bares the soil on steep slopes.

Reforestation

Reforestation includes natural regeneration, hand and machine planting and direct seeding. Reforestation poses little threat to water quality and is a recommended practice where filter strips are needed to trap sediment.

Since some exposure of mineral soil occurs with machine planting, there is some concern for soil erosion.

Recommended Practices

1. Refer to the Streamside Zone section for information on machine planting in these areas.
2. Hand plant tree seedlings on steep slopes. Mechanical tree planters are unsafe for effective operation on steep terrain.
3. Refer to USDA Natural Resource Conservation Service soil interpretations to help determine the extent of soils suited for tree planting. Soil information is available through Natural Resource Conservation Service District Conservationist offices located in most counties.

Forest Protection (Prescribed Burning and Fire Lines)

Prescribed fire is a useful silvicultural tool when used properly. However, poor planning and weather conditions can cause too much heat in a prescribed burn, completely destroying the humus layer on the forest floor and exposing the soil for erosion.

Recommended Practices

1. Carefully plan and execute the use of prescribed fire in forestry situations while observing weather conditions.
2. Prior to burning, locate firebreaks along the contour as much as possible.
3. Use the blade of the fire dozer to scrape fire lines or use a low impact fire plow. Use water bars if it is believed necessary on deep soil, pasture or steep slopes (Table 4). In forest conditions little or no soil loss is experienced from fire line construction. Leaf accumulation in the fire line helps protect the soil.
4. Use foam products away from streams.

Chemical Treatment (Pesticides and Herbicides)

Chemicals used in silvicultural practices are applied occasionally to small acreages and at low application rates. All chemicals recommended for use in forest management activities in Missouri are registered for that use. The Missouri Department of Agriculture regulates chemical use through certification of foresters and applicators.

Chemicals should be used, chemical containers disposed of, and application equipment cleaned by following the directions found on the chemical container label. Careful use of chemicals on timber stand improvements, site preparation practices and weed control in plantations does not result in prolonged or serious water quality degradation. Special restrictions have been placed on the use of pesticides in watersheds containing rare, threatened and endangered species. For chemical use near water, refer to the practices found in the section on Streamside Zones.

Fertilization

Silvicultural use of fertilizers in Missouri is virtually non-existent. Except for special cases such as tree planting on mining spoils, research projects, nursery operations and on urban trees, fertilizer is not used on large scale forest management practices.

Glossary

Access Road — A temporary or permanent road over which timber is transported from a landing site to a public road. Also known as a haul road.

Basal Area — Measured in square feet and based on the diameter of trees measured at four and one-half feet above the ground.

Broad-Based Dip — Also called a rolling dip, this is a drainage structure designed to drain water off of a dirt road while vehicles maintain normal haul speeds.

Buffer strip — A barrier of permanent vegetation established or left undisturbed downslope from disturbed forest areas to filter out sediment from runoff before it reaches a watercourse. Buffer strips help stabilize streambanks, protect flood plains from flood damage and provide important fish and wildlife habitat.

Chemicals — Chemical substances or formulations that perform important functions in forest management. They include fertilizers, herbicides, repellents and other chemicals.

Commercial Forest Land — Forest land bearing, or capable of bearing, timber of commercial character, currently or prospectively available, and not withdrawn from such use.

Contour — An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting points of the same elevation.

Coarse Debris — Fallen trees, limbs, and rock of all sizes that have accumulated on the ground which provide a cover over the soil.

Culvert — Either a metal or concrete pipe, or a constructed box-type conduit, through which water is carried under roads.

Disking — A mechanical method of scarifying the soil to reduce competing vegetation and to prepare a site for seeding or planting.

Ephemeral Streams- Water flows only during or immediately after rain. SMZ is not required.

Erosion — The process by which soil particles are detached, entrained and transported by water, wind, and gravity to some downslope or downstream point.

Evenage Management System — Forest harvesting system results in stands of trees of approximately the same age.

Felling — The process of cutting down standing trees.

Forest Land — Land bearing forest growth or land from which the forest has been removed, but which shows evidence of past forest occupancy and which is not now in other use.

Forest Practice — The activity of growing, protecting, harvesting, or processing of forest tree species on forest land. Manipulation of forest resources for other benefits such as wildlife and recreation, etc., is also included.

Forest Road — An access route for vehicles into forest land.

Harvesting — The felling, skidding, loading, and transporting of timber products (pulpwood, poles, sawlogs, etc.).

Herbicide — Any substance or mixture of substances intended to prevent the growth or destroy unwanted trees, bushes, weeds, algae, and other aquatic weeds.

Intermittent Stream — A watercourse when water flows in a well-defined channel nonperiodically. Same as a wet-weather stream.

Litter Layer — The layer of fallen leaves, twigs and decaying woody material that provides a sponge-like mat covering forest soils.

Live Stream — See Perennial Stream.

Log Landing — Also called log deck, log yard, brow or bunching area. A place where logs or tree-length materials are assembled for loading and transport.

Logging Debris — The unutilized and generally unmarketable accumulation of woody material such as large limbs, tops, cull logs and stumps, that remains after timber harvesting.

Mulch — Any loose soil covering of organic residues, such as grass, straw, or wood fibers that helps to check erosion and stabilize exposed soil.

Non-Ephemeral Stream - A stream (perennial or intermittent) that has a defined channel and often have banks. This type of stream drains 120 acres or greater of a forested watershed or has permanent pools of water in the channel or has a continuous flow of water throughout the year. Water flows more than immediately after a rain. SMZ is required.

Non-Point Source Pollution — Water pollution caused by diffuse sources that are not regulated as point sources and normally are associated with agricultural, silvicultural, urban and construction site runoff. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological or radiological integrity of a discharge at a specific single location (such as a pipe), but generally results from land runoff, precipitation, atmospheric deposition or percolation (DNR).

Perennial Stream — A watercourse that flows throughout the year in a well defined channel. Same as a live stream.

Pesticides — Chemical materials that are used for the control of undesirable insects, disease, vegetation, animals or other forms of life.

Prescribed Burning — Using controlled fires to reduce or eliminate the unincorporated organic matter of the forest floor or undesirable vegetation.

Recommended Practices — A practice or combination of practices determined to be the most effective, practical means of achieving water quality objectives.

Regeneration — The young tree crop replacing older trees removed by harvest or disaster; the process of replacing old trees with young ones.

Retirement of Road — Preparing a road for a long period of non-use. Methods include mulching, seeding, installing water bars, etc.

Rotation (Period) — The period of time to establish, grow and harvest a crop of trees at a specified condition of maturity.

Silviculture — Practices that are directed toward the creation and maintenance of a forest that will best fulfill the objectives of the owner (Smith). Cutting a forest as part of a land use change, as in the conversion of forest to pasture, cropland, parking lot or another non-forest use, is not a silvicultural practice.

Site Preparation — A forest activity to remove unwanted vegetation and other material, and to cultivate or prepare the soil for reforestation. Includes bulldozing, brush hogging and use of herbicides.

Skid — Moving logs or felled trees along the surface of the ground from the stump to the point of loading.

Skid Road — A temporary, frequently used pathway to drag felled trees or logs to a log landing.

Slope Percent — The grade of a hill expressed in terms of percent. A vertical rise of 10 feet and a horizontal distance of 100 feet equals a 10 percent slope.

Streamside-Zone — An area adjacent to the banks of streams and bodies of open water where extra precaution is necessary in carrying out forest practices to protect the streambank and water quality.

Thermal Pollution — A temperature rise in a body of water sufficient to harm aquatic life.

Timber Stand Improvement — Intermediate cuttings used to control the stocking, quality and tree species composition of a timber stand. Pruning of tree branches is included.

Tree Canopy — The upper part of the forest consisting of individual tree crowns or the interlocking of tree branches..

Water Bar — A hump or small dike-like surface drainage structure. Used to divert water from fire lines, abandoned skid trails and roads.

Unevenage Management System — Results in two to three age classes of trees as the result of harvesting.

Water Bar — A hump or small dike-like surface drainage structure, properly used only in closing retired roads to traffic, on fire lines, and on abandoned skid trails.

Watercourse — A channel where water flows either perennially or intermittently. Can be also used to include bodies of open water.

Watershed Area — All land and water within the confines of a surface drainage divide.

Water Turnout — The extension of an access road's drainage ditch into a vegetated area to provide for the dispersion and filtration of storm water runoff.

Wet - Weather Stream — See Intermittent Stream.

Windrow — Logging debris and unmerchantable woody vegetation that has been piled into rows to be burned or allowed to decompose; or the act of constructing these.

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Notes

Notes



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